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FOREST RESEARCH NOTES

U.S.DEPARTMENT OF AGRICULTURE
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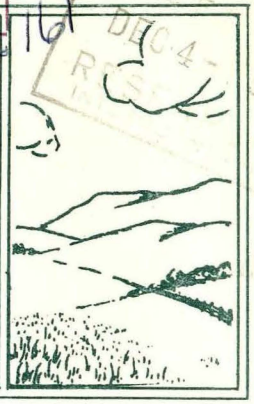

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EFFECTS OF GROUND COVER AND CLASS OF PLANTING STOCK ON SURVIVAL OF TRANSPLANTS IN THE EASTSIDE PINE TYPE OF CALIFORNIA

By

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When the forester finds planting necessary to regenerate an area he should know which species and class of planting stock is best suited to his particular operation. He should also weigh the expected successes on various locations which could be planted. Through such a procedure the best planting locations will be given priority and the best results, measured by survival and growth, will be obtained from the efforts expended. A test conducted at the Blacks Mountain Experimental Forest, an area typical of the California eastside pine type, has shown that survival of ponderosa pine (Pinus ponderosa Laws.) and Jeffrey pine (P. jeffreyi Grev. and Balf.) planting stock is strongly affected by the vegetation, logging slash, and stoniness of the ground at the points where the trees are planted.

In this experiment 1,200 trees were planted in the spring of 1951 on recently cutover land of various aspects. An equal number of ponderosa pine and Jeffrey pine were planted, half of each species being 1-0 and half 1-1 nursery stock. In planting, the trees were spaced 6 x 6 feet in a randomized block design. This note reports the results after two years.

Survival by Species and Classes of Planting Stock

Survival rates for the various types of planting stock were considerably different, becoming greater with time (figure 1 and following tabulation).

Planting stock		Percent survival First year	Second year
Ponderosa pine	1-1	67	60
Jeffrey pine	1-1	52	47
Jeffrey pine	1-0	48	39
Ponderosa pine	1-0	42	30
All		52	44

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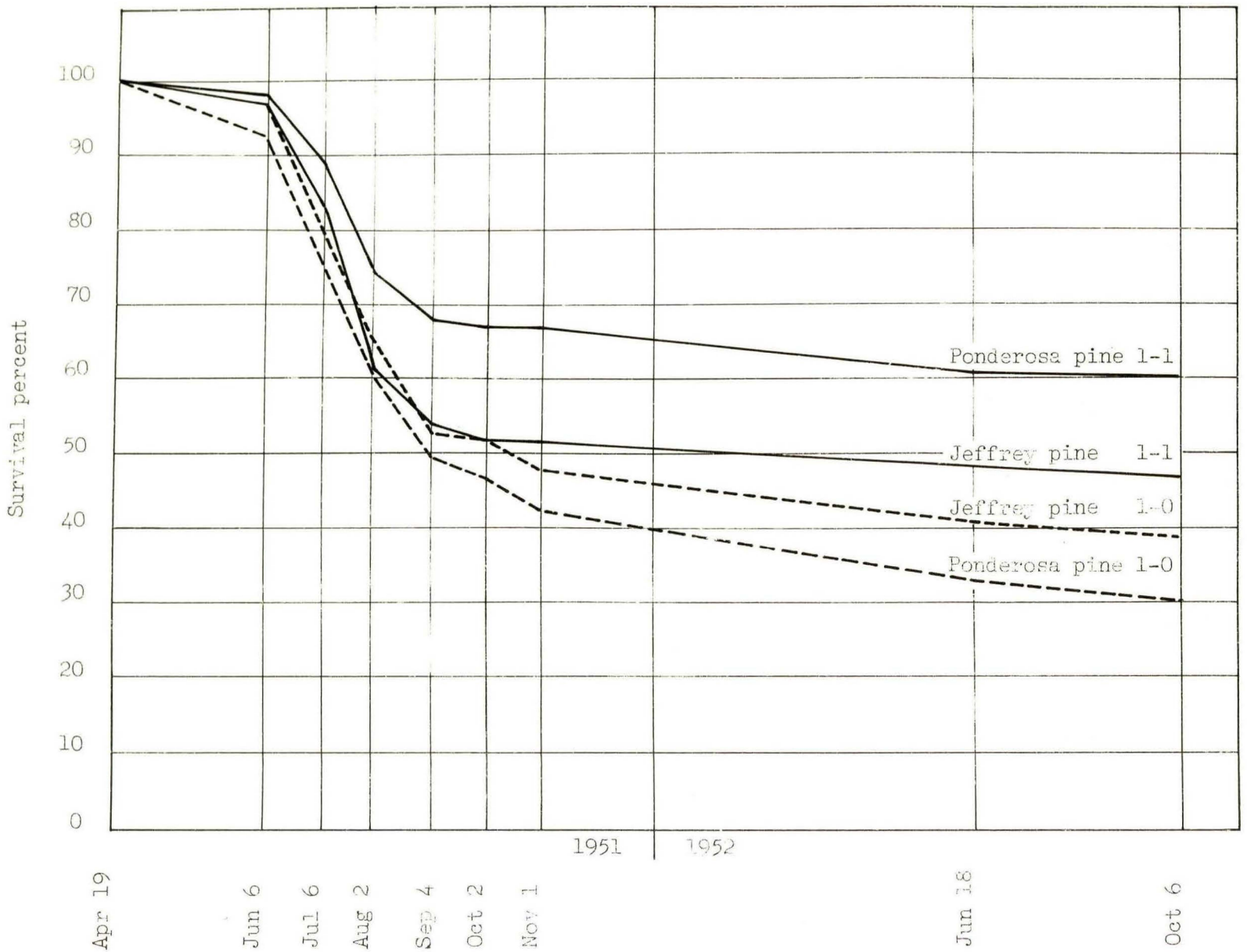

Figure 1.--Survival of four classes of stock planted in the spring, 1951, at Blacks Mountain Experimental Forest.

Ponderosa pine 1-1 stock had the best first- and second-year survival, and Jeffrey pine 1-1 stock was second best. According to variance analyses the difference in survival between age classes of stock was significant for the first year and highly significant the second year. Differences between species were not significant. The better average survival of transplants is consistent with general experience in California so the results do not alter recommendations for choice of planting stock.

Effects of Ground Conditions Upon Survival

Observations concerning the effect of particular habitat where each tree was planted add more to our understanding of factors affecting success in planting than does the performance of types of planting stock.

To secure habitat data the ground conditions and the density of cover were classified after planting for each 4 x 4 foot area surrounding the tree. The surface conditions were (a) bare mineral soil, (b) slash, (c) stones, (d) squaw carpet (Ceanothus prostratus Benth.), (e) other shrubs (including common sagebrush, Artemisia tridentata Nutt.), and (f) grass or sedge (Carex rossii Booth.). A planted spot was classified as having a light cover if only 1 to 25 percent of the area was covered; medium if 26 to 50 percent; heavy if 51 to 75 percent; and very heavy if 76 to 100 percent was covered.

On the average, the trees survived best on bare soil which had no stones; second best under slash; third on open stony ground; fourth in shrub cover; fifth in grass and sedge; and last in sqaw carpet (table 1). The density of the stones or ground cover also affected survival. For example, planted spots with light slash had the best survival, but spots covered with heavy slash had relatively low survival.

The differences in survival appear to be associated chiefly with differences in soil moisture supply. Vegetation depletes the soil moisture, and stones lessen the moisture-holding capacity of the soil mass. Heavy slash makes it difficult for the planter to prevent surface debris from dropping into the planting hole. This debris is generally dry, and, therefore, reduces the moisture immediately available to the newly planted tree. Debris may also cause air pockets and excessive drying.

Slash also provides shelter for rodents, making convenient places for feeding on the young trees. Browsing rodents killed a significant number of planted stock.

Table 1.--Second-year survival of planted stock by ground conditions and density of cover

Ground condition	Survival when stones or ground cover was: 0 (none)	1 - 25 (very light)	26 - 50 (light)	51 - 75 (heavy)	76 - 100 (very heavy)	All
	percent					
Bare	56 (239)[1/]	--	--	--	--	56 (239)
Slash	--	63 (83)	55 (91)	48 (50)	31 (16)	55 (240)
Stones	--	47 (257)	44 (152)	38 (71)	21 (56)	42 (536)
Shrubs	--	45 (11)	38 (13)	17 (6)	0 (1)	35 (31)
Grass and sedge	--	35 (60)	9 (47)	0 (31)	0 (6)	17 (144)
Squaw carpet	--	0 (4)	0 (5)	0 (1)	--	0 (10)
All	56 (239)	51 (654)	41 (308)	33 (159)	22 (79)	44 (1,200)

1/ Numbers in parentheses show the number of planting spots in each ground condition and density classification.

Statistical Analyses

Statistical analyses indicate that survival percentages depend upon ground conditions and the type of stock planted. For comparisons (Chi-square) of survival for different habitat conditions the data were grouped into five ground condition-density classes: (a) bare, (b) light non-living cover or stoniness (1-50 percent), (c) heavy non-living cover or stoniness (51-100 percent), (d) light living cover (1-50 percent), and (e) heavy living cover (51-100 percent).

After two years, differences between ground condition classes were either significant or highly significant for every type of planting stock with one exception--Jeffrey pine 1-0 stock (table 2). Differences in survival were highly significant between types of stock planted in spots without vegetation; but under light or heavy vegetative cover, where survival was universally poor, differences between planting stock were not significant.

Table 2.--Survival two years after planting by type of planting stock and ground condition groups

Ground condition	Survival by types of planting stock					Significance of differences between types of planting stock
	P.P.1-0	J.P.1-0	J.P.1-1	P.P.1-1	All	
	percent					
Bare	37 (46)[1/]	50 (62)	62 (69)	71 (62)	56 (239)	Not significant
Light non-living cover or stoniness	36 (159)	41 (150)	55 (124)	68 (150)	50 (583)	Highly significant
Heavy non-living cover or stoniness	19 (47)	34 (44)	27 (56)	63 (46)	35 (193)	Highly significant
Light living cover	20 (35)	26 (35)	38 (42)	11 (28)	25 (140)	Not significant
Heavy living cover	0 (13)	0 (9)	0 (9)	7 (14)	2 (45)	Not significant
All	30 (300)	39 (300)	47 (300)	60 (300)	44 (1,200)	Highly significant
Significance of differences between ground condition classes[2/]	S	N	HS	HS	HS	

1/ Figures in parentheses show numbers of planting spots in each ground surface condition group and planting stock classification.

2/ HS - highly significant
S - significant
N - not significant

CONCLUSIONS

Planting locations should be selected carefully. Stony and grassy areas should not be planted if more suitable places also need planting. If grassy, shrubby, or slash-covered sites must be planted they should be prepared by scarification, slash disposal, or other appropriate treatment.

Even in favorable planting areas, tree planters should be taught to select the best spots to plant, rather than be guided by mechanical spacing alone. Small patches of grass or other vegetation should be avoided, as well as very stony spots, or areas of heavy slash.

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